County	Sweet Grass	**Upstream River Mile**	468.5
Classification	PCB: Partially confined braided	**Downstream River Mile**	463
General Location	Upstream of Big Timber	**Length**	5.50 mi (8.85 km)

Narrative Summary

Reach A3 is 5.5 miles long and is just located upstream of the town of Big Timber. It is classified as a Partially Confined Braided (PCB) reach type indicating some valley wall influence and relative extensive open gravel bars and low flow secondary channels. This reach shows the passive loss of miles of anabranching channel length since 1950, similar to Reach A2 just upstream. The river has converted from having more than one primary channel to having a dominant main thread with intermittent side channels.

About 12.5 percent of the banks in Reach A3 are armored, with the majority of that armor being rock riprap. Between 2001 and 2011, about 1,700 feet of new bank armor, of which 277 feet are flow deflectors, were installed. There are about 2,000 feet of floodplain dikes in the reach.

Similar to Reach A2 just upstream, this reach has experienced extensive loss of anabranching channel length since 1950. In 1950, the total length of anabranching channels was 6.7 miles, and by 2001 that length had dropped to 4.7 miles, resulting in a reduction in braiding parameter of 17 percent.

Reach A3 shows a reduction in floodplain turnover rates since 1976; prior to that time, average rates of turnover were 103 acres per year, and since that time the average rate of floodplain erosion by the river has been reduced to 65.4 acres per year.

Land use in Reach A3 is predominantly agricultural, with about ½ of all agricultural acreage in flood irrigation. Approximately 13 percent of the 5-year floodplain has been isolated in the reach. This isolation reflects the slight reduction in the magnitude flows in this reach due primarily to irrigation-related withdrawals upstream.

Over 600 acres of wetland have been mapped in Reach A3, most of which is emergent marshes and wet meadows on the south side of the river. The 4.6 acres of Russian olive mapped is dispersed throughout the riparian corridor.

Almost 50 acres of riparian forest per valley mile is considered at low risk of cowbird infestation due to its relative distance from agricultural infrastructure that provides cowbird foraging habitat.

This area of the upper Yellowstone River has seen three severe floods in the last 20 years. The 1996 and 1997 floods were very damaging, early-June events that peaked at 37,100 and 38,000 cfs, respectively. At the time, these were considered to be sequential 100-year floods. Then in late June of 2011, the river peaked at 40,600 cfs, which is currently the flood of record at Livingston. This flood exceeded a 100-year event, with both the 1996/1997 events considered to have exceeded a 75-year flood.

A hydrologic evaluation of flow depletions indicates that flow alterations over the last century have been moderate in this reach. The mean annual flood is estimated to have dropped from 11,900 cfs to 11,500 cfs, a drop of about 3.4 percent. The biggest influence has been on low flows: severe low flows described as 7Q10 (the lowest average 7-day flow anticipated every ten years) for summer months has dropped from an estimated 1,770 cfs to 1,580 cfs with human development, a reduction of 11 percent. More typical summer low flows, described as the summer 95% flow duration, have dropped from 1,760 cfs under unregulated conditions to 1,680 cfs under regulated conditions at the Livingston gage, a reduction of 4.6 percent.

CEA-Related observations in Reach A3 include:
- Passive abandonment of over two miles of side channel since 1950.
- Conversion from a river channel with multiple large primary channels to a single main thread with small anabranches.
- Reduced floodplain turnover rates.

Recommended Practices (may include Yellowstone River Recommended Practices--YRRPs) for Reach A3 include:
- Russian olive removal
- Wetland management/restoration due to high density of mapped emergent wetland

Yellowstone River Reach Narratives — Reach A3

The following table summarizes some key CEA results that have been used to describe overall condition and types of human influences affecting the river. The values are specific to this single reach. Blanks indicate that a particular value was not available for this area. This information is consolidated from a large dataset that is presented in more detail in the full reach narrative report.

Discharge	Undev.	Developed	% Change	"Undeveloped" flows represent conditions prior to significant human development, whereas "developed" flows reflect the current condition of both consumptive and non-consumptive water use.
2 Year (cfs)	23,300	22,900	-1.7%	
100 Year (cfs)	43,400	43,200	-0.5%	

Bankfull Channel Area (Ac)	1950	1976	1995	2001	1950-2001	Bankful channel area is the total footprint of the river inundated at approx. the 2-year flood.
	343.5	379.6	366.8	376.5	33.0	

Physical Features	2011 Length (ft)	% of Bankline	2001-2011 Change	There are additional types of bank armor such as car bodies and steel retaining walls, but they are relatively minor.
Rock RipRap	6,765	12.0%	1,291	
Concrete Riprap	0	0.0%	0	
Flow Deflectors	277	0.5%	277	
Total	**7,042**	**12.5%**	**1,568**	

Length of Side Channels Blocked (ft)	Pre-1950s	Post-1950s	Numerous side channels have been blocked by small dikes.
	0	0	

Floodplain Turnover	1950 - 1976	1976 - 2001	1950-2001 In-channel riparian encroachment (negative number indicates retreat)	The rate of floodplain turnover reflects how many acres of land are eroded by the river. Tunover is associated with the creation of riparian habitat.
Total Acres	103.0	65.4	-7.98 acres	
Acres/Year	4.0	2.6		
Acres/Year/Valley Mile	0.9	0.6		

Open Bar Area	Point Bars	Bank Attached	Mid-Channel	Total	The type and extent of open sand and gravel bars reflect in-stream habitat conditions that can be important to fish, amphibians, and ground-nesting birds such as least terns.
Change in Area '50 - '01 (Ac)					

Floodplain Isolation	Acres	% of FP	Floodplain isolation refers to area that historically was flooded, but has become isolated do to flow alterations or physical features such as levees.
5 Year	13.2	3%	
100 Year	0.0	0%	

Restricted Migration Area	Acres	% of CMZ	Channel Migration Zone restrictions refer to the area and percent of the CMZ that has been isolated by features such as bank armor, dikes, levees, and transportation embankments.
	99.5	9%	

Land Use	1950	2011		1950	2011	Changes in land use reflect the development of the river corridor through time. The irrigated agricultural are is a sub-set of the mapped agricultural land.
Agricultural Land (Ac)	3,050.1	2,981.2	Flood (Ac)	1,492.4	1,670.4	
Ag. Infrastructure (Ac)	7.3	22.0	Sprinkler (Ac)	0.0	0.0	
Exurban (Ac)	0.0	0.0				
Urban (Ac)	0.0	0.0	Pivot (Ac)	0.0	0.0	
Transportation (Ac)	3.3	6.3				

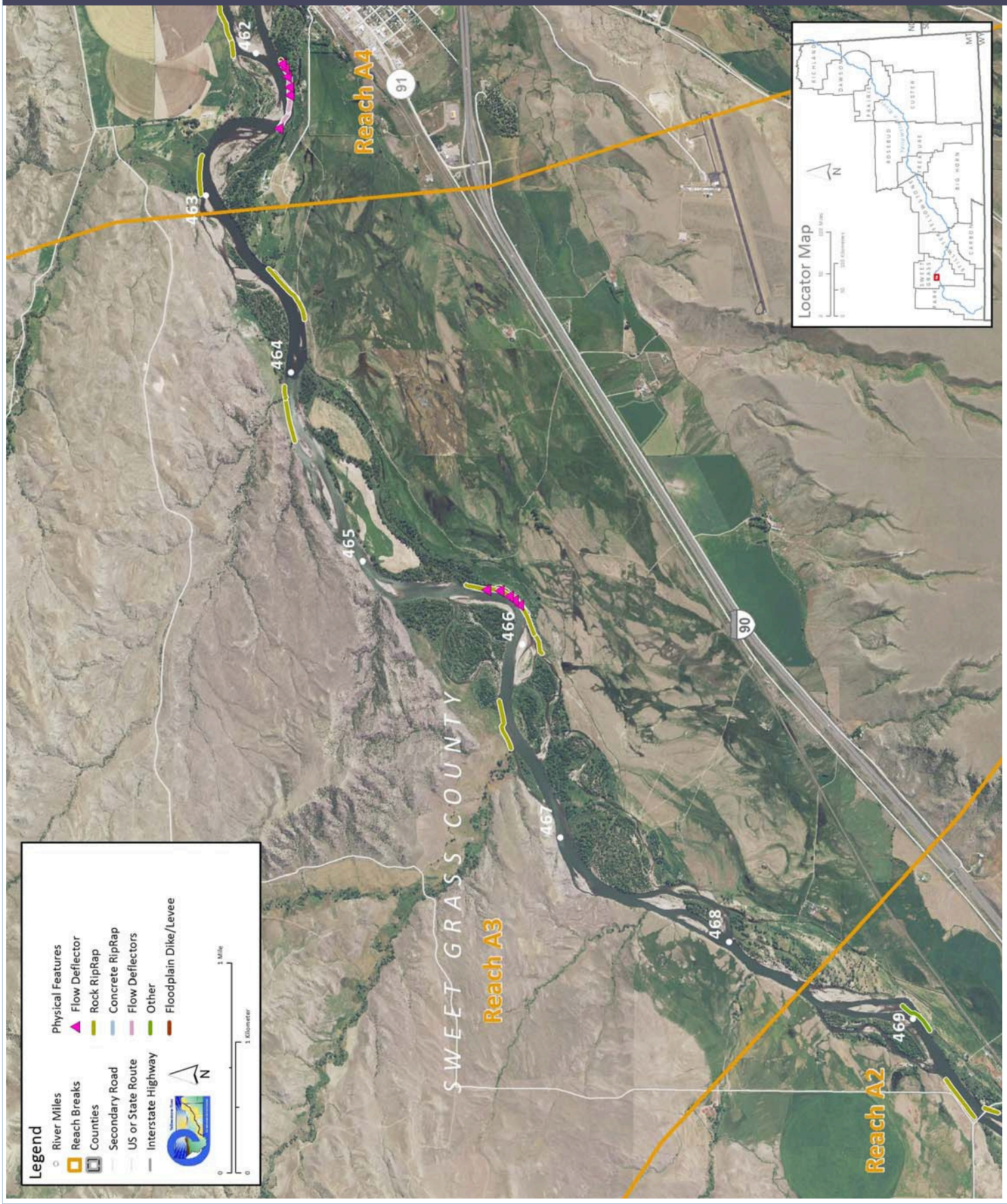
1950s Riparian Vegetation Converted to a Developed Land Use (ac)	To Irrigated	To Other Use	Total Rip. Converted	% of 1950s Rip.	Changes in the extents of riparian vegetation are influenced by land use changes within the corridor.
	3.6	0.0	3.6	1.0%	

National Wetlands Inventory	Acres	Acres per Valley Mi	Total Wetland Acres	Wetlands units summarized from National Wetlands Inventory Mapping include Riverine (typically open water sloughs), Emergent (marshes and wet meadows) and Shrub-Scrub (open bar areas with colonizing woody vegetation).
Riverine	5.1	1.1		
Emergent	558.7	120.5	**650.3**	
Scrub/Shrub	86.5	18.7		

Russian Olive (2001) (Appx. 100-yr Floodplain)	Acres	%	Russian olive is considered an invasive species and its presence in the corridor is fairly recent. Its spread can be used as a general indicator of invasive plants within the corridor.
	4.6	0.3%	

Riparian Forest at low risk of Cowbird Parasitism (Ac/Valley Mile)	1950	1976	2001	Change 1950-2011	Cowbirds are associated with agricultural and residential development, displacing native bird species by parasitizing their nests.
	46.4	60.5	49.5	3.0	

PHYSICAL FEATURES MAP (2011)



CHANNEL MIGRATION ZONE MAP